# Titer determination of strong acids

## Description

This application report describes the general procedure for the titer determination of aqueous strong acids like Hydrochloric acid, Sulfuric acid, Perchloric acid and Nitric acid. The procedure is also usable for strong acids in water-soluble organic solvents like alcohols. It is not suitable for titer determination of Perchloric acid in Glacial acetic acid.
The titer is a dimensionless number about 1 for correcting the indicated concentration. In the software of the titration devices and application reports from SI Analytics®, the term “Titer“ describes the exact concentration in mol/l and not the dimensionless factor.

## Instruments

| | |
|---|---|
| Titrator | TL 7000 or higher |
| Exchangeable Unit | WA 20 |
| Electrode | N 62 or A 7780 1M-DIN-ID or similar |
| Cable | L 1 A (only for electrodes with plug head) |
| Stirrer | Magnetic stirrer TM 235 or similar |
| Lab accessoires | Glas beaker 150 ml |
| | Magnetic stirrer bar 30 mm |

## Reagents

| | |
|---|---|
| 1 | the acid from which the titer is to be determined |
| 2 | Distilled water |
| 3 | Tris(hydroxymethyl)-aminomethan (TRIS) – certified reference material, volumetric standard |
| 4 | KCl solution 3 mol/l |
| All reagents should be in analytical grade or better. | |

## Titration procedure

### Reagents

The TRIS volumetric standard is dried as described in the corresponding certificate of analysis, mostly 24h at room temperature over drying agent.

The distilled water has to be free of $CO_2$ or Carbonate. In order to remove any CO2, the water is briefly boiled and allowed to cool down in a covered container.

### Cleaning and storage of the electrode

Use distilled water for cleaning the electrode. For storage use KCl solution 3 mol/l or electrolyte solution L 911.

### Sample preparation

The amount of volumetric standard depends on the size of the burette and the concentration of the acid. The amount should be chosen so that about half of the burette volume is consumed. The most common is the 20 ml burette. The required quantity of TRIS can be estimated according to this rule of thumb:

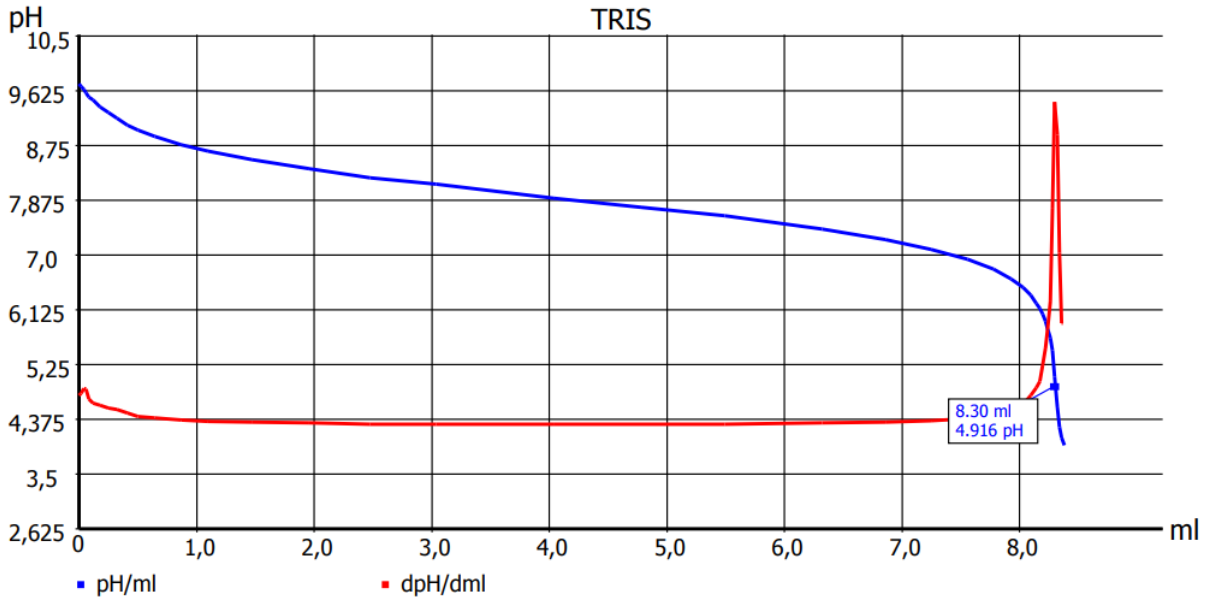
$$W\ [g] = Concentration[mol/l]$$

To determine the titer of a 0.1 mol/l acid, about 0.12 g TRIS volumetric standard are weighed into a 150 ml beaker with an accuracy of 0.1 mg and filled up to 80 ml with distilled, $CO_2$-free water. When the TRIS is completely dissolved, the acid is titrated to an EQ.

If the specified assay of the volumetric standard is significantly different from 100%, the weight for calculating the concentration must be corrected:

$$W = \frac{Weight * specified\ assay\ \%}{100}$$

## Titration parameter




| | | | |
|---|---|---|---|
| Default method | Titre HCl | | |
| Method type | Automatic titration | | |
| Modus | Dynamic | | |
| Measured value | pH | | |
| Measuring speed / drift | Normal | Minimum holding time | 2 s |
| | | Maximum holding time | 15 s |
| | | Measuring time | 2 s |
| | | Drift | 20 mV/min |
| Initial waiting time | 0 s | | |
| Dynamic | Steep | Max step size | 1.0 ml |
| | | Slope max ml | 15 |
| | | Min. step size | 0,02 ml |
| | | Slope min. ml | 230 |
| Damping | None | Titration direction | Decrease |
| Pretitration | off | Delay time | 0 s |
| End value | 2.5 | | |
| EQ | on | Slope value | 700 |
| Max. titration volume | 20 ml | | |
| Dosing speed | 100% | Filling speed | 30 s |

Calculation:

$$T\ [mol/l] = \frac{W * F2}{(EQ - B) * M * F1}$$

| | | |
|---|---|---|
| B | 0 | Blank value |
| W | man | Weight of the sample [g] |
| F2 | 1000 | Conversion factor ml - l |
| EQ1 | | Consumption of titrant until first Equivalence point |
| M | 121,136 | Molecular mass |
| F1 | 1 | Conversion factor |

We recommend to write the exact concentration T to the Exchangable Unit (WA) automatically.

Any questions? Please contact the application team:

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